

Do **not** use for new designs. Use the RF212 device instead (Data Sheet No. 100780)



RF210A and RF210B

Dual-Band, Image-Reject Downconverters For GSM Applications

The RF210A and RF210B devices are available as a dual-band front end for Global System for Mobile Communications (GSM) handset applications. Both of these highly integrated, monolithic devices are optimized for dual-band use in GSM900/DCS1800 or GSM 900/PCS1900 applications. The devices include two Low Noise Amplifiers (LNAs), two image-reject mixers, and two Local Oscillator (LO) buffer amplifiers.

The main advantage of the RF210A and RF210B is their ability to provide 30 dB of image rejection for both the GSM900 and the DCS1800 (or PCS1900) bands without requiring the use of a post-LNA image reject filter. A block diagram of the RF210(A/B) is shown in Figure 1. The device package and pin configuration are shown in Figure 2.

Features

- LNA/image-reject mixer for RF to IF conversion
- 10 dB (RF210A) or 20 dB (RF210B) switchable gain for GSM
- 8 dB (RF210A) or 16 dB (RF210B) switchable gain for DCS/PCS
- 30 dB of image rejection. No post-LNA filtering required
- High isolation LO input buffer
- Differential IF output
- High dynamic range
- Three-cell battery operation (2.7 to 5 V)
- 20-pin Thin Shrink Small Outline Package (TSSOP)

Applications

- Dual-band digital cellular mobile telephony (GSM900/DCS 1800 or GSM900/PCS1900)

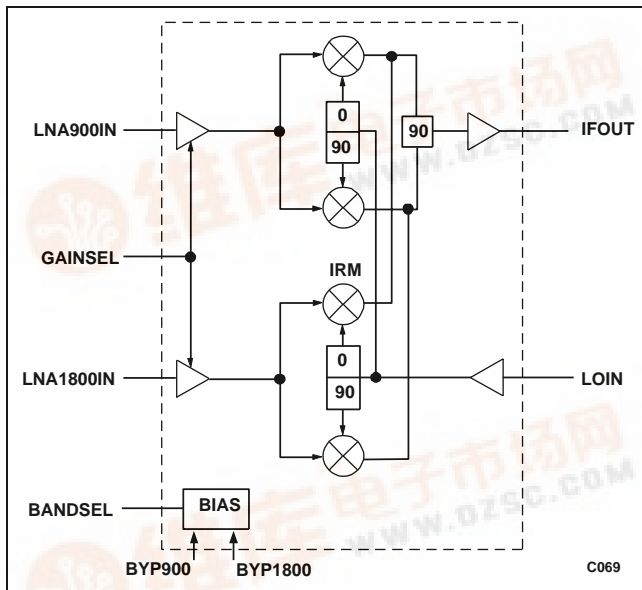


Figure 1. RF210(A/B) Block Diagram

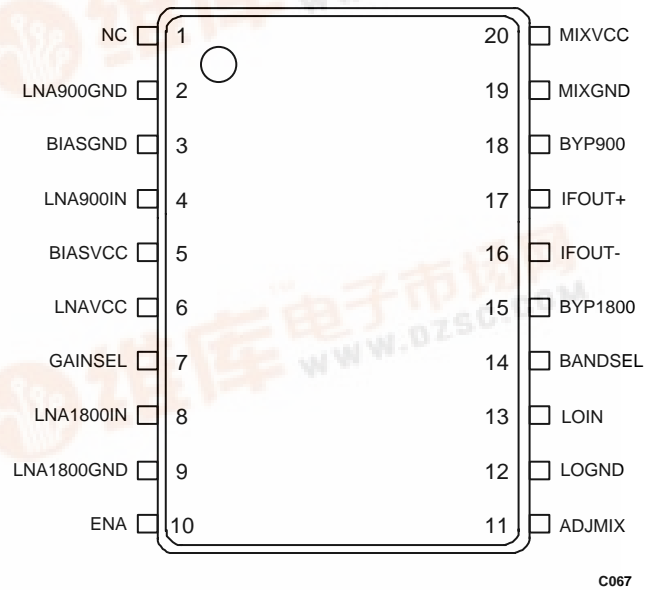
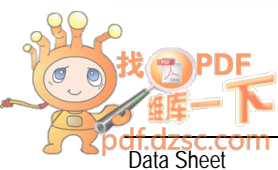


Figure 2. RF210(A/B) Pin Configuration – 20-Pin TSSOP



Technical Description

The RF210(A/B) dual-band, image-reject downconverters implement the front-end functions of a dual-band super-heterodyne receiver. These devices consist of two receive paths, one for GSM900 and the other for DCS1800 (or PCS1900). Each receive path contains an LNA and an image-reject mixer. The IF and LO ports are common to both receive paths. The image-reject mixers can provide 30 dB of image rejection for both the GSM900 and the DCS1800 (or PCS1900) bands without using any post-LNA image reject filters.

The LNA/mixer combination has a switchable gain. The RF210A and RF210B both have 22 dB of gain in the high gain mode. For the RF210A, the gain is reduced by 10 dB (GSM band) and by 8 dB (DCS/PCS band) in the low gain mode. For the RF210B, the gain is reduced by 20 dB (GSM band) and by 16 dB (DCS/PCS band) in the low gain mode. The gain mode is selected using the GAINSEL pin (Pin 7). Low gain mode is selected by driving the GAINSEL signal high; high gain mode is selected by driving the signal low. In addition, small adjustments

of the mixer gain can be accomplished by varying the quiescent current on the ADJMIX pin (Pin 11). This pin can be connected to VCC or ground through resistors. The current will increase if the pin is connected to GND and decrease if connected to VCC. For optimal performance, this pin should be left unconnected.

The band of operation for RF210(A/B) is selected by the BANDSEL signal on Pin 14. It switches the receive path between GSM900 and DCS1800 (or PCS1900) bands.

The device can operate from a three-cell battery pack (2.7 V to 5.0 V). Standby mode current is extremely low at 20 μ A, which maximizes handset standby time.

The signal pin assignments and functional pin descriptions are found in Table 1. The absolute maximum ratings of the RF210(A/B) are provided in Table 2, the operating conditions are specified in Table 3, and electrical specifications are provided in Table 4. Figure 3 shows the diagram for a typical application circuit using the RF210(A/B) downconverter. Figure 4 provides the package dimensions for the 20-pin TSSOP device and Figure 5 provides the tape and reel dimensions.

Table 1. RF210(A/B) Signal Description

Pin #	Name	Description	Pin #	Name	Description
1	NC	No connect	11	ADJMIX	Mixer bias adjust pin
2	LNA900GND	900 MHz LNA ground	12	LOGND	LO input ground
3	BIASGND	Bias ground	13	LOIN	LO input
4	LNA900IN	900 MHz LNA input	14	BANDSEL	Band selection pin
5	BIASVCC	Bias supply	15	BYP1800	Bypass capacitor for 1800 MHz band
6	LNAVCC	LNA supply	16	IFOUT-	Mixer output (negative)
7	GAINSEL	LNA gain select	17	IFOUT+	Mixer output (positive)
8	LNA1800IN	1800 MHz LNA input	18	BYP900	Bypass capacitor for 900 MHz band
9	LNA1800GND	1800 MHz LNA ground	19	MIXGND	Mixer ground
10	ENA	Device enable (active high)	20	MIXVCC	Mixer supply

Table 2. Absolute Maximum Ratings

Parameter	Minimum	Maximum	Units
Storage Temperature	-40	+125	$^{\circ}$ C
LNA Input Power		+5	dBm
Supply Voltage (VCC)	-0.3	+6	V
Input Voltage Range	-0.3	Vcc	V

Table 3. RF210(A/B) Recommended Operating Conditions

Parameter	Min	Typical	Max	Units
Supply Voltage	2.7	3.0	5.0	V
Operating Temperature	-30	+25	+85	°C

Table 4. RF210(A/B) Electrical Specifications (1 of 2)
(T_A = 25 C, V_{CC} = 3.0 V, f_{IF} = 400 MHz, P_{IO} = -10 dBm)

Parameter	Test Condition	Min	Typical	Max	Units
GSM900 Mode, BANDSEL = 0					
Supply current:					
Enable mode	ENA = 1		38		mA
Sleep mode	ENA = 0			10	µA
RF Input frequency		935		960	MHz
IF frequency		350	400	450	MHz
LO frequency		1285		1410	MHz
LO input power			-10		dBm
LO to RF input isolation		30			dB
Input impedance	LNA900IN = 950 MHz		40 - j50		Ω
Gain:					
High gain (RF210A and RF210B)	GAINSEL = 0		22		dB
Low gain (10 dB attenuation, RF210A)	GAINSEL = 1		12		dB
Low gain (20 dB attenuation, RF210B)	GAINSEL = 1		2		dB
Gain variation vs. Frequency			0.5	1	dB
Gain step tracking error				0.5	dB
Noise figure:					
High gain	No blocker, GAINSEL = 0		3.3	3.9	dB
Low gain (12 dB gain, RF210A)	GAINSEL = 1		9.0	11	dB
Low gain (2 dB gain, RF210B)	GAINSEL = 1		17	19	dB
High gain (Note 1)	-28 dBm blocker @ 915 MHz, GAINSEL = 0		3.9		dB
Input 1 dB compression point		-25			dBm
Input third order intercept point		-17			dBm
IF shunt resistance/side		400	500	600	Ω
Spurious response: 2(RF) x 2(LO) and 3(RF) x 3(LO) (Note 2):	Interferer input = -75 dBm		-45		dB
Image rejection		35			dB

Table 4. RF210(A/B) Electrical Specifications (2 of 2)
 (T_A = 25 C, V_{CC} = 3.0 V, f_{IF} = 400 MHz, P_{IO} = -10 dBm)

Parameter	Test Condition	Min	Typical	Max	Units
DCS1800/PCS1900 Mode, BANDSEL = 1					
Supply current: Enable mode Sleep mode	EN A = 1 EN A = 0		42	250	mA μA
RF input frequency		1805		1990	MHz
IF frequency		350	400	450	MHz
LO frequency		1355		1640	MHz
LO to RF input isolation		30			dB
Input impedance	LNA1800IN = 1900 MHz		40 - j10		Ω
Gain: High gain (RF210A and RF210B) Low gain (8 dB attenuation, RF210A) Low gain (16 dB attenuation, RF210B) Gain variation vs. Frequency Gain step tracking error	GAINSEL = 0 GAINSEL = 1 GAINSEL = 1		19 11 3 0.5	1 0.5	dB dB dB dB dB
Noise figure: High gain (19 dB gain, RF210A and RF210B) Low gain (11 dB gain, RF210A) Low gain (3 dB gain, RF210B) High gain (19 dB gain, RF210A and RF210B) (Note 3)	No blocker, GAINSEL = 0 GAINSEL = 1 GAINSEL = 1 -22 dBm blocker, GAINSEL = 0		3.5 9.0 15 4.1	4.5 11 16	dB dB dB dB
Input 1 dB compression point		-24			dBm
Input third order intercept point		-17			dBm
IF shunt resistance/side		400	500	600	Ω
Spurious response (Note 2): 2(RF) x 2(LO) and 3(RF) x 3(LO)	Interferer = -65 dBm		-53		dB
Image rejection		35			dB
Control Signals (All Modes)					
Enable (ENA) and gain select (GAINSEL) input voltages: V _{HI} V _{LI}		1.9		0.8	V V
Enable (ENA) and gain select (GAINSEL) input currents: I _{HI} I _{LI}		-10	20 -1	100 0	μA μA
Enable time			15		μs
Bandselect switching time			15		μs
Note 1: Assumes 0 dBm @ 915 MHz blocker at the antenna input attenuated by 28 dB.					
Note 2: The rejection is specified with respect to the desired signal gain.					
Note 3: Assumes -12 dBm @ 1785 MHz blocker at the antenna input attenuated by 10 dB.					

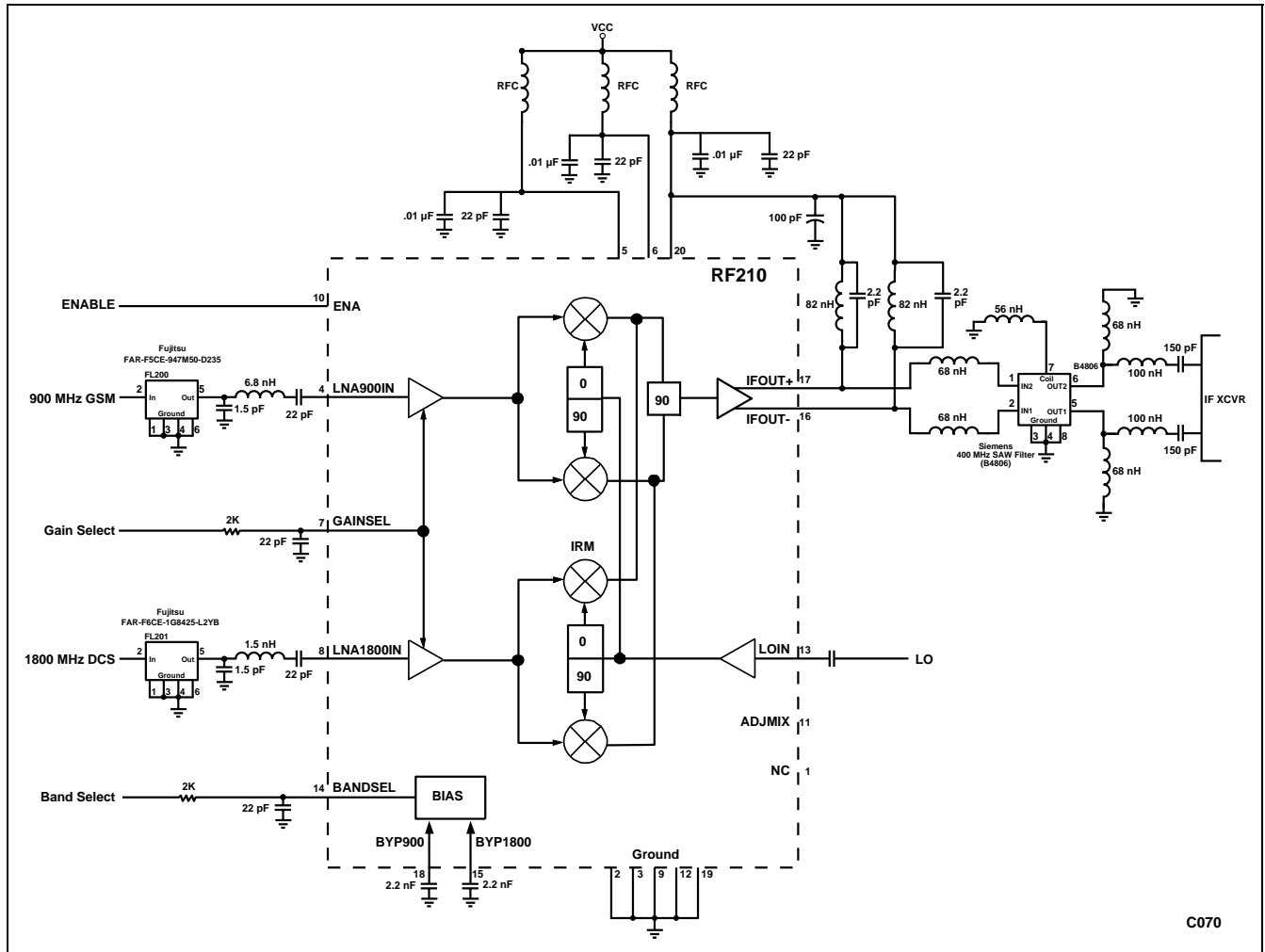


Figure 3. Typical RF210(A/B) Application Circuit

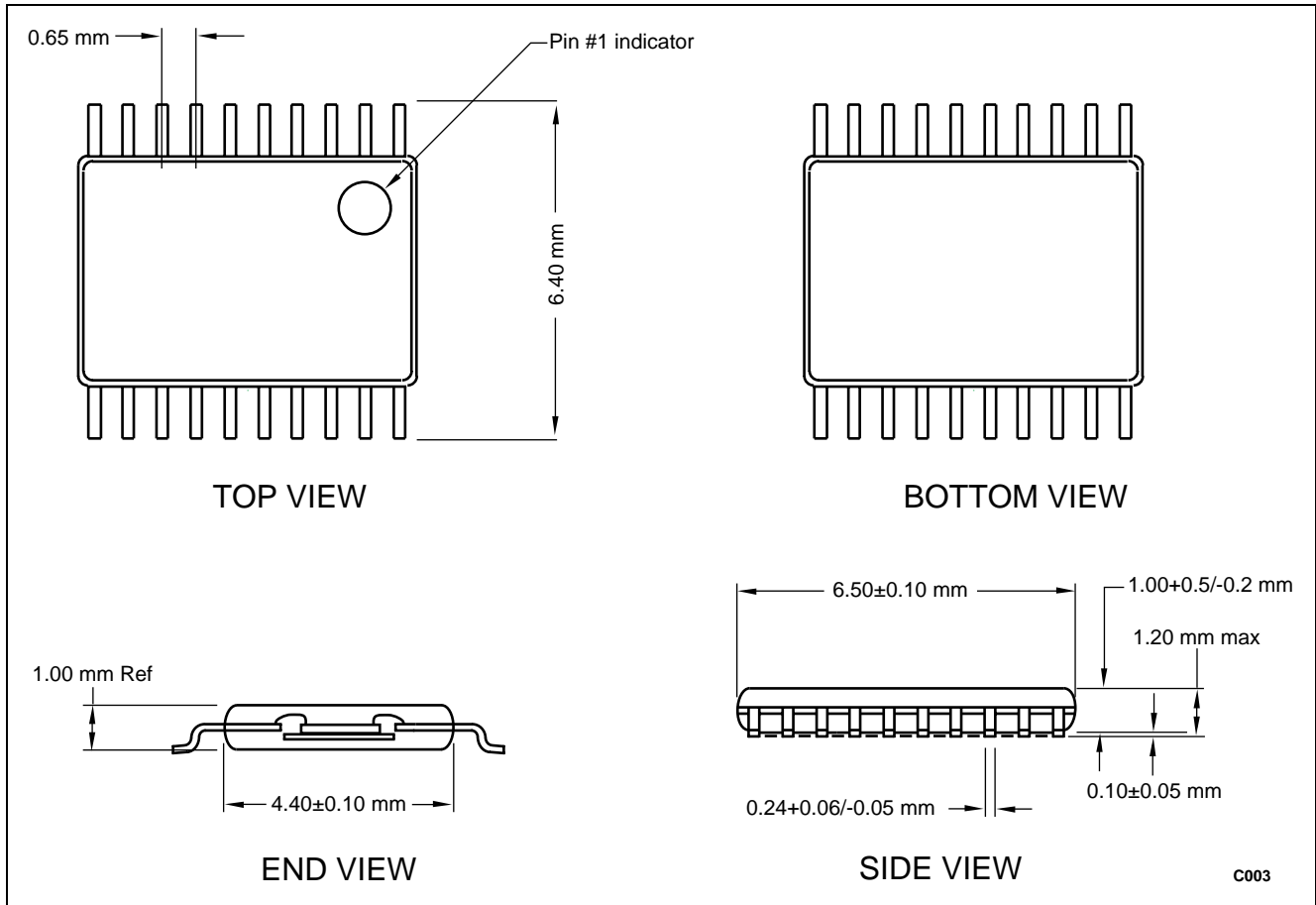


Figure 4. RF210(A/B) Package Dimensions – 20-Pin TSSOP

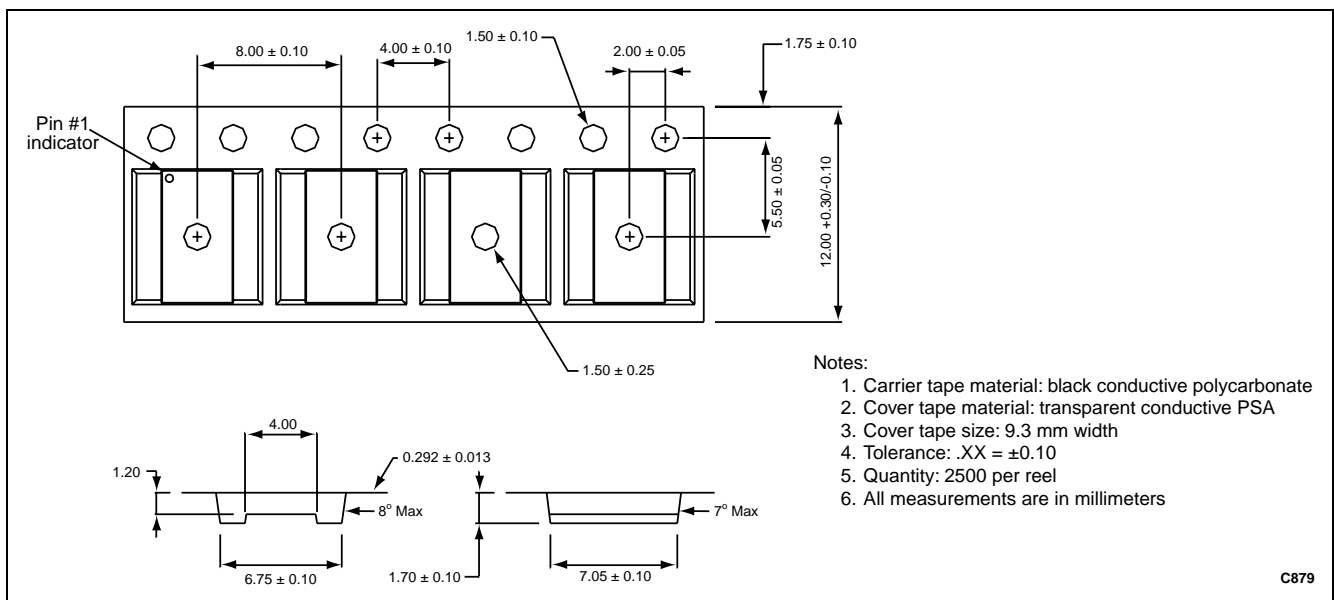


Figure 5. RF210(A/B) Tape and Reel Dimensions

Ordering Information

Model Name	Manufacturing Part Number	Product Revision
Dual-Band, Image-Reject Downconverter: 10 dB switchable gain 20 dB switchable gain	RF210A RF210B	

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